

California Environmental Protection Agency
AIR RESOURCES BOARD

PROPOSED

**CALIFORNIA ZERO-EMISSION AND HYBRID ELECTRIC VEHICLE
EXHAUST EMISSION STANDARDS AND TEST PROCEDURES
FOR 2003 AND SUBSEQUENT MODEL
PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES**

Adopted: _____

Note: This new document is being created to accommodate the modifications to 40 CFR Subpart S being proposed by the U.S. EPA pertaining to certification streamlining for light- and medium-duty vehicles. Most of the text previously appeared in the LDV/MDV TPs. Changes specifically pertaining to LEV II are shown in underline and ~~strikeout~~ to indicate additions and deletions, respectively.

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A. Applicability

The emission standards and test procedures contained herein are applicable to 2003 and subsequent model-year zero-emission and hybrid electric passenger cars, light-duty trucks and medium-duty vehicles produced and delivered for sale in California. The general procedures and requirements necessary to certify a vehicle for sale in California are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (hereinafter "LDV/MDV TPs"), except as amended herein.

B. Definitions

In addition to the following, these test procedures incorporate by reference the definitions set forth in the Title 40 Code of Federal Regulations §86.1803-01 and the definitions set forth in the LDV/MDV TPs.

"All-Electric Range Test" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see Section F of these test procedures).

"Battery pack" means any electrical energy storage device consisting of any number of individual battery modules or cells that is used to propel electric or hybrid electric vehicles.

"Electric vehicle" means any vehicle that operates solely by use of a battery or battery pack. This definition also includes vehicles which are powered mainly through the use of an electric battery or battery pack, but which use a flywheel or ultracapacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

"Fuel fired heater" means a fuel burning device that creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

"Off-vehicle charge capable" means having the capability to charge a battery pack from an off-vehicle source such as a powerplant.

"UDDS" means urban dynamometer driving schedule. See 40 CFR §86.115.

"HFEDS" means highway fuel economy driving schedule. See 40 CFR §600.109(b).

"Zero-emission vehicle" or "ZEV" means any vehicle certified to zero-emission standards.

"Zero-emission VMT" means the vehicle miles traveled with zero exhaust emissions of any criteria pollutant (or precursor pollutant).

C. Zero-Emission Vehicle Standards.

1. Demonstrating Compliance with the ZEV standards.

1.1 ZEV Standard. The Executive Officer shall certify as ZEVs vehicles that produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions.

1.2. Fuel Fired Heater Emission Standards. Incorporation of a fuel fired heater shall not preclude a vehicle from being certified as a ZEV provided the fuel fired heater cannot be operated at ambient temperatures above 40°F and the heater is demonstrated to have zero fuel evaporative emissions under any and all possible operational modes and conditions. In addition, the emissions of the fuel-fired heater shall not be greater than the emissions of a vehicle certified to the ULEV standards when operated between 68°F - 86°F as set forth in Section E.1.1.2 of the LDV/MDV TPs and the heater is demonstrated to have zero fuel evaporative emissions under any and all possible operational modes and conditions. If the emissions of the fuel fired heater exceed the applicable ULEV standards when operated between 68°F - 86°F, the vehicle shall not certify as a ZEV but shall certify according to the emission level of the fuel fired heater. Vehicles that utilize fuel fired heaters that can be operated at ambient temperatures above 40° F or which cannot be demonstrated to have zero fuel evaporative emissions under any and all possible operation modes and conditions shall not be certified as ZEVs and shall be certified according to the emission level of the fuel fired heater.

2. Phase-In Requirements. In 2003 and subsequent model years, at least 10% of a manufacturer's PC and LDT 0-3750 lbs. LVW ("LDT1") fleet based on the production volume ("ZEV requirement") shall be certified, produced and delivered for sale in California as Section C.1, or D.2 vehicles according to the following restrictions:

2.1 Large Volume Manufacturers. In 2003 and subsequent model years, a large-volume manufacturer must meet at least 40% of its ZEV requirement with ZEVs as determined in Section C.1 of these test procedures and/or as vehicles with a 1.0 total partial ZEV Allowance as determined in Section D.2 of these test procedures. The remainder of the ZEV requirement can be met using vehicles meeting the partial ZEV Allowance criteria set forth in Section D.2 of these test procedures.

2.2 Intermediate Volume Manufacturers. In 2003 and subsequent model years, an intermediate volume manufacturer as defined in Section I.B.2 of the LDV/MDV TPs may meet the ZEV requirement using vehicles that meet the requirements set forth in Section D.2 of these procedures.

2.3 Small Volume Manufacturers. A small volume manufacturer, as defined in Section I.A.1 of the LDV/MDV TPs, shall not be required to meet the percentage ZEV

requirements. However, a small volume manufacturer may earn and market credits for the ZEVs or partial ZEV Allowance vehicles it produces and delivers for sale in California.

3. Fleet Average NMOG Requirements. Vehicles certified to the ZEV emission standards in Section C.1 or Section D.2.2 vehicles that receive a 1.0 partial ZEV Allowance shall be counted as ZEVs for the purpose of calculating the fleet average Non-Methane Organic Gas (“NMOG”) exhaust emission value and NMOG credits under Part I.E of the LDV/MDV TPs, and for calculating ZEV credits as set forth in Section D below. Except for vehicles that receive a 1.0 partial ZEV Allowance, vehicles meeting the criteria set forth in Section D.2 shall be counted as SULEVs certified to the 150,000 mile standards in the fleet average NMOG equation and may qualify for partial ZEV Allowance credits as set forth in Section D below.

4. Implementation Prior to 2003. Prior to the 2003 model year, a manufacturer that voluntarily produces vehicles meeting the ZEV emission standards applicable to 2003 and subsequent model year vehicles may certify those vehicles as ZEVs for the purposes of calculating fleet average NMOG exhaust emission values and NMOG credits under Part I.E of the LDV/MDV TPs, and calculating ZEV credits as set forth in Section D below.

5. Small and Intermediate Volume Manufacturer Requirements. In 2003 and subsequent model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an intermediate volume manufacturer’s average California production volume exceeds 35,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume or intermediate manufacturer, as applicable, and shall comply with the ZEV requirements applicable to intermediate or large volume manufacturers beginning with the fourth model year after the last of the three consecutive model years. If a manufacturer's average California production volume falls below 4,500 or 35,000 units of new PCs, LDTs, and MDVs, as applicable, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small or intermediate volume manufacturer, as applicable, and shall be subject to requirements for a small or intermediate volume manufacturer beginning with the next model year.

D. Determination of ZEV Credits.

1. **Calculation of ZEV Credits.** A manufacturer that produces and delivers for sale in California Section C.1, D.2.1 and/or D.2.2 vehicles exceeding the ZEV requirement in a given model year set forth in Section C.2 shall earn ZEV credits or partial ZEV Allowance credits. The sum of these resulting credits shall be multiplied by the NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year and expressed in units of g/mi NMOG.

1.1. ZEV Multiplier Calculation Criteria for ~~2001 and 2002~~ 1999 to 2007 Model Years. Prior to the 2003 model year, Each Section C.1 ZEV and/or Section D.2.2 vehicle receiving a 1.0 partial ZEV Allowance produced and delivered for sale in the ~~2001 and 2002~~ 1999 to 2007 model years shall earn credits that may be counted as follows:

All-electric range	MY 1999-2000	MY 2000 -2002	MY 2003-2005	MY 2006-2007
100-175	6-10	4-6	2-4	1-2

~~1.1.1 For model years 2001 and 2002, additional ZEV credits will be determined by linear interpolation between the values shown in the above schedule. Range shall be determined in accordance with Section F.3.(2)(a) and battery specific energy shall be determined in accordance with Section F.4 of these test procedures. ZEVs that have a refueling time of less than 10 minutes shall be counted as having unlimited all-electric range and consequently, shall qualify to receive the maximum allowable ZEV multiplier for a specific model year.~~

~~1.1.2 For purposes of calculating ZEV credits, a ZEV may be counted according to vehicle range or battery specific energy but not both.~~

~~1.1.32 For purposes of calculating a manufacturer's fleet average NMOG value contained in Section E.2 of the LDV/MDV TPs, each ZEV shall be counted as one vehicle.~~

~~1.1.4 All ZEV credits earned prior to the 2003 model year shall be treated as if earned in the 2003 model year.~~

1.2 Credit Calculation for 1999 and Subsequent Model Years.

1.2.1 The amount of ZEV credits earned shall be equal to the number of Section C.1 ZEVs that a manufacturer applies towards meeting the ZEV requirements for the model year (at least 40% of the ZEV requirement for large volume manufacturers) subtracted from the [number of Section C.1 ZEVs plus the number of Section D.2.2 ZEVs

receiving a 1.0 partial ZEV Allowance] produced and delivered for sale in the model year multiplied by ZEV multiplier wherever applicable. The resulting ZEV credits shall be multiplied by the NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year and expressed in units of g/mi NMOG.

1.2.2 The amount of partial ZEV Allowance credits (a number not to exceed 60% of the ZEV requirement for large volume manufacturers) shall be equal to the number of Section D.2 vehicles, except those granted a partial ZEV Allowance of 1.0 that a manufacturer applies towards meeting the ZEV requirement for the model year subtracted from the number of D.2.1 and/or D.2.2 vehicles, except those granted a partial ZEV Allowance of 1.0, produced and delivered for sale in the model year. The resulting partial ZEV Allowance credits shall be multiplied by the NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for that model year and expressed in units of g/mi NMOG.

1.2.3 ZEV credits and partial ZEV Allowance credits shall be maintained as separate categories. Large volume manufacturers shall not use partial ZEV Allowance credits to satisfy any deficits in meeting the requirement that 40% of the ZEV requirement must be met using Section C.1 vehicles or Section D.2 vehicles receiving a partial ZEV Allowance of 1.0.

2. Determination of Partial ZEV Allowance.

2.1 Baseline Partial ZEV Allowance. In order for a vehicle to be eligible to receive any partial ZEV Allowance, a manufacturer must demonstrate compliance with all of the following requirements. A vehicle that demonstrates compliance with the following requirements shall receive a partial ZEV Allowance of 0.2.

2.1.1 Certify to the SULEV standard at 150,000 miles for PCs and LDTs set forth in Section E.1.1.2 of the LDV/MDV TPs;

2.1.2 Certify to the evaporative emission standards set forth in Section I.E.1.(d) of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (zero evap standards);

2.1.3 Certify that the vehicle will meet the applicable on-board diagnostic requirements in Title 13, CCR §1968.1 at 150,000 miles;

2.1.4 Extend the performance and defects warranty period set forth in Title 13, CCR §§2037(b)(2), and 2038(b)(2) to 15 years or 150,000 miles, whichever occurs first.

2.2 A vehicle that meets the requirements of subparagraph 2.1, above, shall also be eligible to receive additional partial ZEV allowances by meeting one or more of the following requirements:

2.2.1 Zero-emission VMT ZEV Allowance. Under this category, a vehicle may receive a ZEV Allowance either under subsection 2.2.1.1 or subsection 2.2.1.2 but not both.

2.2.1.1 A vehicle that has zero-emission vehicle miles traveled (“VMT”) capability shall receive a partial ZEV Allowance, not to exceed 0.6, according to the following equation:

$$\text{Zero-emission VMT Partial ZEV Allowance} = 0.6 \times \text{Zero-Emission VMT Factor}$$

where zero-emission VMT factor is the ratio of the zero-emission miles the vehicle travels to the total miles traveled per trip.

(a) Zero-emission VMT factors are calculated as follows:

<u>Urban All-Electric Range</u>	<u>Zero-emission VMT Factors:</u>
<u>< 20 miles</u>	<u>0.0</u>
<u>≤ 20 miles to < 100 miles</u>	<u>(30 + [0.5 x Urban AER])/80</u>
<u>≥ 100 miles</u>	<u>1.0</u>

Urban All-electric range (“Urban AER”) is determined in accordance with the procedures set forth in Section F.(3)(a) of these test procedures.

(b) A manufacturer may submit an alternative procedure for prior approval by the Executive Officer to determine the zero-emission VMT potential of the vehicle as a percent of total VMT provided the manufacturer provides an engineering evaluation to substantiate the zero-emission VMT determination. On approval, the Executive Officer shall assign a zero-emission VMT factor not to exceed 1.0. For example, a vehicle with zero-emissions of one regulated pollutant (e.g. NOx) and not another (e.g. NMOG) may qualify for a zero-emission VMT factor of 0.5.

(c) Vehicles meeting the criteria set forth in Section D.2 and that are assigned a partial ZEV Allowance of less than 1.0 shall be counted as SULEVs in the fleet average NMOG equation.

(d) HEVs with all-electric range greater than 20-miles and equipped with software and/or other strategies that would promote maximum use of off-vehicle charging qualify for an additional partial ZEV Allowance of 0.1. The Executive Officer shall approve the 0.1 additional zero-emission VMT ZEV Allowance based on whether the strategy is tamper-proof, effective, or other similar factors.

2.2.1.2 Vehicles that do not qualify for any ZEV Allowance under Section 2.2.1.1 may qualify for a ZEV Allowance of 0.1 if the vehicle is equipped with advanced ZEV componentry such as an advanced battery integral to the operation of the vehicle power-train, an electric power-train and/or other potential ZEV technologies subject to approval by the Executive Officer.

2.2.2 Partial ZEV Allowance for Fuel-cycle Emissions. A vehicle that uses fuel(s) with very low fuel-cycle emissions shall receive a partial ZEV Allowance not to exceed 0.2. In order to receive the fuel-cycle partial ZEV Allowance, a manufacturer must demonstrate, using peer-reviewed studies or other relevant information approved by the Executive Officer, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions and the uncertainty in the results must be quantified. This partial ZEV Allowance is calculated according to the following formula:

Partial ZEV Fuel Cycle Allowance = 0.2 x (percent of VMT using fuel(s) meeting the requirements of 2.2.2 above)

A manufacturer must submit test results and/or empirical data supporting the estimate of the relative proportion of VMT while operating on fuel(s) with very low fuel-cycle emissions for prior approval by the Executive Officer.

2.3 Calculation of Total Partial ZEV Allowance. The total partial ZEV Allowance assigned to a vehicle, not to exceed 1.0, is the sum of partial ZEV Allowances earned according to the requirements set forth in 2.1 and 2.2.

Step 1: Does the vehicle meet SULEV standard at 150,000 miles and have a 150,000 mile emission warranty?
A) If yes, vehicle receives 0.2 in this category and go to step 2. _____

B) If no, vehicle does not qualify for any ZEV Allowance and go to step 4.

Step 2: Estimate the zero-emission VMT factor.
Is the zero-emission VMT factor greater than zero?
A) If yes, compute zero-emission VMT Allowance and

write it in this line and go to step 3. _____

B) If no, is the vehicle equipped with advanced ZEV componentry?

If yes, write 0.1 on this line. _____

Go to step 3.

Step 3. Does the vehicle use fuels that have low-fuel cycle emissions?

A) If yes, estimate the low-fuel cycle emissions partial ZEV Allowance and write it on this line. Go to step 4. _____

B) If no, go to step 4.

Step 4. Sum the values (if any) from steps 1-3

This the total partial ZEV Allowance applicable to the vehicle. _____

2.4 Vehicles receiving the maximum allowable partial ZEV Allowance of 1.0 will be considered a Section C.1 ZEV for purposes of the phase-in requirements set forth in Section C.2 of these test procedures.

2.5 Except for vehicles that receive a total partial ZEV Allowance of 1.0, the partial ZEV Allowance can only be used to meet the 60% maximum ZEV requirement set forth in Section C.2 of these test procedures.

3. **Credit Discounting.** The emission credits earned in any given model year shall not be discounted in subsequent model years retain full value through the subsequent model year. ~~The value of any credits not used to equalize the previous model year's debit, shall be discounted by 50% at the beginning of second model year after being earned, discounted to 25% of its original value if not used by the beginning of the third model year after being earned, and will have no value if not used by the beginning of the fourth model year after being earned.~~

4. **Submittal of ZEV Credits.** A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV and partial ZEV Allowance credits. These credits may be earned previously by the manufacturer or acquired from another manufacturer. The amount of ZEV and partial ZEV Allowance credits required to be submitted shall be calculated according to the criteria set forth in Section D of these procedures.

5. **Requirement to Make Up a ZEV Deficit.** A manufacturer that certifies, produces, and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by subtracting the number of ZEVs and Section D.2 vehicles receiving a partial ZEV

allowance produced and delivered for sale in California by the manufacturer for the model year from the number of ZEVs required to be produced by the manufacturer for the model year and then multiplying by the fleet average requirements for PCs and LDTs 0-3750 lbs. LVW for the model year in which the deficit is incurred. A large volume manufacturer shall not use partial ZEV allowance credits to satisfy any Section C.1 ZEV deficits.

6. **Penalty for Failure to Meet ZEV Requirements.** Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs or submit an appropriate amount of ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code § 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code §43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equations:

6.1 Section C.1 ZEVs or Section D.2. vehicles receiving a Partial ZEV Allowance of 1.0

(No. of Section C.1 ZEVs or Section D.2. vehicles receiving a partial ZEV allowance of 1.0 required to be produced and delivered for sale in California for the model year) - (No of Section C.1 ZEVs or Section D.2 vehicles receiving a partial ZEV allowance of 1.0 produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model-year)].

6.2 Section D.2. vehicles receiving a Partial ZEV Allowance.

(No. of Section D.2 vehicles required to be produced and delivered for sale in California for the model year) - (No of Section D.2 vehicles produced and delivered for sale in California for the model year) - [(Amount of ZEV credits or Partial ZEV Allowance Credits submitted for the model year) / (the fleet average requirement for PCs and LDTs 0-3750 lbs. LVW for the model-year)].

7. **ZEV Credits for MDVs, LDTs 3751-5750 lbs. LVW and LDTs 3751 lbs. LVW - 8500 lbs. GVW.** ZEVs or Section D.2 vehicles classified as MDVs or as LDTs 3751-5750 lbs. LVW or LDTs 3751 lbs. LVW - 8500 lbs. GVW may be counted toward the ZEV requirement for PCs and LDTs 0-3750 lbs. LVW and included in the calculation of ZEV credits as specified in Section D if the manufacturer so designates.

E. Certification Requirements

1. Durability and Emission Testing Requirements. All ZEVs are exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

2. Information Requirements: Application for Certification. Except as noted below, the Part I (40 CFR §86.1839-01(c)) certification application shall include the following:

- 2.1 Identification and description of the vehicle(s) covered by the application.
- 2.2 Identification of the vehicle weight category to which the vehicle is certifying: PC, LDT 0-3750 lbs. LVW, LDT 3751-5750 lbs. LVW, LDT 3751 lbs. - 8500 lbs. GVW, or MDV (state test weight range), and the curb weight and gross vehicle weight rating of the vehicle.
- 2.3 Identification and description of the propulsion system for the vehicle.
- 2.4 Identification and description of the climate control system used on the vehicle.
- 2.5 Projected number of vehicles produced and delivered for sale in California, and projected California sales.
- 2.6 Identification of the energy usage in kilowatt-hours per mile from:
 - (a) the battery output (DC energy) (to be submitted with the Part II certification application (40 CFR 86.1839-01(d)):
 - (b) the point when electricity is introduced from the electrical outlet (AC energy); and
 - (c) the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test set forth in Section F, below.
- 2.7 For those ZEVs and HEVs that use fuel fired heaters, the manufacturer shall provide
 - (a) a description of the control system logic of the fuel fired heater, including an evaluation of the conditions under which the fuel fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist;
 - (b) the exhaust emissions value per mile produced by the auxiliary fuel fired heater operated between 68°F and 86°F; and
 - (c) the test plan which describes the procedure used to determine the mass emissions of the fuel fired heater.
- 2.8 All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the

event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel.

2.9 Method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

2.10 Battery specific energy data and calculations as specified in Section F.4 of these procedures including the weight of the battery system and the three hour discharge rate (C/3) energy capacity.

2.11 Vehicle and battery break-in period as specified in Section F.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in Title 13, CCR §1965 and the California Motor Vehicle Emission Control and Smog Index Label Specifications.

F. Test Procedures

1. Electric Dynamometer. All ZEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2).

2. Vehicle and Battery Break-In Period. A manufacturer shall use good engineering judgment in determining the proper stabilized emissions mileage test point and report same according to the requirements of Section E.2.11 above.

3. All-Electric Range Test. All 2001 and subsequent ZEVs and ~~Type A and Type B~~ only off-vehicle charge capable hybrid electric vehicles shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of a ZEV or of an off-vehicle charge capable hybrid electric vehicle operating without the use of its auxiliary power unit. For hybrid electric vehicles, the manufacturer may elect to conduct the All-Electric Range Test prior to vehicle preconditioning in the exhaust and evaporative emission test sequence specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR.

(1) **Cold soak.** The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge.

(2) **Driving schedule.**

(a) **Determination of All-Electric Range-Urban.** At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through successive an Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference, until the vehicle is no longer able to maintain the speed or time tolerances contained in 40 CFR §86.115-00(b)(1) and (2). ~~within 5 miles per hour of the speed requirements or within 2 seconds of the time requirements of the driving schedule.~~ A 10-minute soak will follow each UDDS cycle. This test sequence will be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2). For off- vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

(b) **Determination of All-Electric Range-Highway.** At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through a two successive Highway Fuel Economy Driving Schedules (HFEDS), found in 40 CFR, Part 600, Appendix I, which is incorporated herein by reference ~~until the vehicle is no longer able to maintain the speed or time tolerances contained in 40 CFR §86.115-00(b)(1) and (2) within 5 miles per hour of the speed requirements or within 2~~

~~seconds of the time requirements of the driving schedule. There shall be a 15 second zero speed with key on and brake depressed between two cycles and a 10-minute soak following the two HFEDS cycles. This test sequence will be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR §86.115-00 (b)(1) and (2). For off-vehicle charge capable hybrid electric vehicles, this determination is optional and shall be performed without the use of the auxiliary power unit.~~

(3) **Recording requirements.** Once the vehicle is no longer able to maintain the speed and time requirements specified in (2) above, or once the auxiliary power unit turns on, in the case of a hybrid electric vehicle, the accumulated mileage and energy usage of the vehicle from the point where electricity is introduced from the electrical outlet (AC energy) and the battery output (DC energy) shall be recorded, and the vehicle shall be brought to an immediate stop, thereby concluding the All-Electric Range Test.

(4) **Regenerative braking.** Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications prior to the commencement of the test. The driving schedule speed and time tolerances specified in (2) shall not be exceeded due to the operation of the regenerative braking system.

4. Determination of Battery Specific Energy for ZEVs

Determine the specific energy of batteries used to power a ZEV in accordance with the U.S. Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in the Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

5. Determination of the Emissions of the Fuel Fired Heater

The exhaust emissions result of the fuel fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.6 minutes per mile for a grams per mile value.

6. Hybrid Electric Vehicle FTP Emission Test Provisions

6.1 Vehicle Preconditioning. To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein with the following revisions to 40 CFR §86.132-90:

6.1.1 Amend subparagraph (a): The battery state-of-charge of the hybrid-electric vehicle shall be set at a level that satisfies one of the following conditions listed in order of hierarchy. If condition (i) cannot be met, then condition (ii) shall be met. If condition (ii) cannot be met, then condition (iii) shall be met:

(i) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to immediately activate the auxiliary power unit at the beginning of the preconditioning drive.

(ii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to activate the auxiliary power unit within 30 seconds of starting the preconditioning drive.

(iii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to operate the auxiliary power unit for the longest amount of cumulative time during the preconditioning drive.

If the auxiliary power unit is capable of being manually activated, the battery state-of-charge shall be set to the lowest level allowed by the manufacturer for charge-sustaining hybrid electric vehicles over the UDDS. If the hybrid electric vehicle is charge-depleting over the UDDS, the battery state-of-charge shall be set to the level recommended by the manufacturer for activating the auxiliary power unit when operating in urban driving conditions. After setting battery state-of-charge, the vehicle shall be pushed to the test area and the following operations performed:

6.1.2 Amend subparagraph (a)(2): Within one hour of being fueled the vehicle shall be place by being pushed on a dynamometer and operated through one UDDS. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive. A test vehicle may not be used to set dynamometer horsepower.

6.1.3 Add subparagraph (a)(5): Within five minutes of completing preconditioning drive, set battery state-of-charge to satisfy one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the UDDS, then set battery state-of-charge to a level such that at the end of the dynamometer procedure (subparagraph 6.2 of these procedures) the battery would not experience a net energy decrease. Test is invalid if battery experiences a net energy decrease at the end of the dynamometer procedure relative to the beginning of the dynamometer procedure.

(ii) If the hybrid electric vehicle is charge-depleting over the UDDS, then no battery state-of-charge adjustment is permissible.

(iii) If auxiliary power unit is capable of being manually activated, then set battery state-of-charge to manufacturer recommended level for activating the auxiliary power unit when the hybrid electric vehicle is operating in urban driving conditions.

6.2 Dynamometer Procedure

To be conducted pursuant to 40 CFR §86.135-94 with the following revisions:

6.2.1 Amend subparagraph (a): Overview. The dynamometer run consists of two tests, a “cold” start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” as incorporated by reference herein, and a “hot” start test following the “cold” start test by 10 minutes. Vehicle startup (with all accessories turned off), operation over the UDDS and vehicle shutdown make a complete cold start test. Vehicle startup and operation over the UDDS and vehicle shutdown make a complete hot start test. The exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. Eight particulate samples are collected on filters for weighing; the first sample plus backup is collected during the first 505 seconds of the cold start test; the second sample plus backup is collected during the remainder of the cold start test (including shutdown); the third sample plus backup is collected during the first 505 seconds of the hot start test; the fourth sample plus backup is collected during the remainder of the hot start test (including shutdown). Continuous proportional samples of gaseous emissions are collected for analysis during each test phase. For hybrid electric vehicles with gasoline-fueled, natural gas-fueled and liquefied petroleum gas-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO₂, CH₄ and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO₂, CH₄ and NO_x. For hybrid electric vehicles with natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO₂, CH₄ and NO_x. For hybrid electric vehicles with methanol-fueled auxiliary power units, methanol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO₂, CH₄ and NO_x.

6.2.2 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the transient cold start, stabilized cold start, transient hot start, and stabilized hot start phases of the test. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

6.3 Dynamometer Test Run, Gaseous and Particulate Emissions

To be conducted pursuant to 40 CFR §86.137-94 with the following revisions:

6.3.1 Amend subparagraph (a): General. The dynamometer run consists of two tests, a cold start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein, and a hot start test following the cold start test by 10 minutes. The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The complete dynamometer test consists of a cold start drive of 7.5 miles (12.1 km) and a hot start drive of 7.5 miles (12.1 km). The vehicle is allowed to stand on the dynamometer during the 10 minute time period between the cold and hot start tests. The cold start test is divided into two periods. The first period, representing the cold start "transient" phase, terminates at the end of the deceleration which is scheduled to occur at 505 seconds of the driving schedule. The second period, representing the "stabilized" phase, consists of the remainder of the driving schedule including vehicle shutdown. The hot start test, similarly, consists of two periods. The first period, representing the hot start "transient" phase, terminates at the same point in driving schedule as the first period of the cold start test. The second period of the hot start test, "stabilized" phase, consists of the remainder of the driving schedule including vehicle shutdown.

6.3.2 Amend subparagraph (9): Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the "transient" exhaust sample bag, the "transient" methanol exhaust sample, the "transient" formaldehyde exhaust sample, the "transient" dilution air sample bag, the "transient" methanol dilution air sample and the "transient" formaldehyde dilution air sample (turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, start particulate sample pump No. 1, and record both gas meter or flow measurement instrument readings, if applicable), and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

6.3.2 Amend subparagraph (14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.5 Amend subparagraph (15): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, turn off the No. 2 particulate sample pump and close the valves isolating particulate filter No. 2, and position the sample selector valves to the "standby" position (and open the valves isolating particulate filter No. 1, if applicable). Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4°C to 10°C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.3 Amend subparagraph (18): Repeat the steps in paragraphs (b)(2) through (b)(15) of this section for the hot start test. The step in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

6.3.4 Delete subparagraph (19)

6.3.5 Amend subparagraph (20): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, turn off the No. 2 particulate sample pump and close the valves isolating particulate filter No. 2, and position the sample selector valves to the "standby" position (and open the valves isolating particulate filter No. 1, if applicable). Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples pursuant to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4°C to 10°C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.6 Amend subparagraph (21): As soon as possible, and in no case longer than one hour after the end of the hot start phase of the test, transfer the eight particulate filters to the weighing chamber for post-test conditioning, if applicable.

6.3.7 Amend subparagraph (24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein.

7. Hybrid Electric Vehicle Highway Emission Test Provisions

To be conducted pursuant to 40 CFR 600.111-93 with the following revisions:

7.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected continuously for subsequent analysis of THC, CO, CO₂, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Methanol and formaldehyde samples are collected and individually analyzed for methanol-fueled vehicles.

7.2 Amend subparagraph (e): Vehicle Preconditioning. The Highway Fuel Economy Dynamometer Procedure is designed to be performed immediately following the Federal Emission Test Procedure as amended by the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein. When conditions allow, the tests should be scheduled in this sequence. In the event the tests cannot be scheduled within three hours of the Federal Emission Test Procedure (including one hour hot soak evaporative loss test, if applicable) the vehicle should be preconditioned as in paragraph (e) (1) or (2) of this section, as applicable. Prior to performing the Highway Fuel Economy Dynamometer Procedure, the battery state-of-charge of the hybrid-electric vehicle shall be set at a level that satisfies one of the following conditions listed in order of hierarchy. Battery state-of-charge setting can be performed before or after securing vehicle to dynamometer. If condition (i) cannot be met, then condition (ii) shall be met. If condition (ii) cannot be met, then condition (iii) shall be met:

(i) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to immediately activate the auxiliary power unit at the beginning of the first cycle of the Highway Fuel Economy Dynamometer Procedure.

(ii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to activate the auxiliary power unit within 10 seconds of starting the first cycle of the Highway Fuel Economy Dynamometer Procedure.

(iii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to operate the auxiliary power unit for the longest amount of cumulative time during the first cycle of the Highway Fuel Economy Dynamometer Procedure.

If the auxiliary power unit is capable of being manually activated, the battery state-of-charge shall be set to the lowest level allowed by the manufacturer for charge-sustaining hybrid electric vehicles over the HFEDS. If the hybrid electric vehicle is charge-depleting over the HFEDS, the battery state-of-charge shall be set to the level recommended by the manufacturer for activating the auxiliary power unit when operating under highway driving conditions.

7.3 Amend subparagraph (f): Highway Fuel Economy Dynamometer Procedure.

(1) The dynamometer procedure consists of two HFEDS separated by 15 seconds of idle. The first HFEDS is driven to precondition the test vehicle and the second HFEDS is driven for the fuel economy measurement.

7.3 Amend subparagraph (f)(3): Only one exhaust sample and one background sample are collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO₂, and NO_x. Methanol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for methanol-fueled vehicles.

7.4 Amend subparagraph (h)(5): Operate the vehicle over one HFEDS according to the dynamometer driving schedule specified in §600.109(b). If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS.

7.4 Amend subparagraph (h)(6): When the vehicle reaches zero speed at the end of the preconditioning cycle, the driver has 17 seconds to prepare for the emission measurement cycle of the test. Reset and enable the roll revolution counter. For hybrid electric vehicles that are charge-sustaining over the HFEDS, the vehicle shall be momentarily turned off for 5 seconds and turned back on. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on. Hybrid electric vehicles that are charge-depleting over the HFEDS and hybrid electric vehicles with auxiliary power units capable of manual activation shall remain turned on during the idle period.

7.5 Amend subparagraph (h)(8): Sampling must begin two seconds before beginning the first acceleration of the fuel economy measurement cycle and must end two seconds

after the end of the deceleration to zero. At the end of the deceleration to zero speed, the roll or shaft revolutions must be recorded. For hybrid electric vehicles that are charge-depleting over the HFEDS and hybrid electric vehicles with auxiliary power units capable of manual activation, the emission test is completed. For hybrid electric vehicles that are charge-sustaining over the HFEDS, record the battery state-of-charge and determine if the net energy change of the battery decreased during the second HFEDS. If the battery experienced a net energy decrease, then repeat dynamometer test run from subparagraph (h)(6). A total of three highway emission tests shall be attempted to satisfy the condition requiring that the battery shall not experience a net energy decrease by the end of the emission test. If this condition is not met in three attempts, then retest the hybrid electric vehicle as a charge-depleting over the HFEDS. Manufacturers may elect to repeat dynamometer test run from subparagraph (h)(6) if battery energy level increased significantly during highway emission test.

8. Hybrid Electric Vehicle SFTP Emission Test Provisions

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 with the following revisions:

8.1.1 Amend subparagraph (n): Aggressive Driving Test (US06)

Preconditioning. (1) If the US06 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). Prior to driving US06 preconditioning cycle, the battery state-of-charge of the hybrid-electric vehicle shall be set at a level that satisfies one of the following conditions listed in order of hierarchy. Battery state-of-charge setting can be performed before or after securing vehicle to dynamometer. If condition (i) cannot be met, then condition (ii) shall be met. If condition (ii) cannot be met, then condition (iii) shall be met:

(i) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to immediately activate the auxiliary power unit at the beginning of the US06 preconditioning cycle.

(ii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to activate the auxiliary power unit within 15 seconds of starting the US06 preconditioning cycle.

(iii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to operate the auxiliary power unit for the longest amount of cumulative time during the US06 preconditioning cycle

If the auxiliary power unit is capable of being manually activated, the battery state-of-charge shall be set to the lowest level allowed by the manufacturer for charge-sustaining hybrid electric vehicles over the USO6. If the hybrid electric vehicle is charge-depleting over the USO6, the battery state-of-charge shall be set to the level recommended by the manufacturer for activating the auxiliary power unit when operating under highway driving conditions. Preconditioning consists of a USO6 test cycle. If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the USO6 preconditioning cycle.

8.1.2 Delete subparagraphs (n)(1)(i) and (n)(1)(ii).

8.2 USO6 Emission Test

To be conducted pursuant to 40 CFR §86.159-00 with the following revisions:

8.2.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during cycle operation, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO₂, CH₄ and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO₂, CH₄ and NO_x.

8.2.2 Amend subparagraph (b)(2): Position (vehicle must be pushed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle can be driven) the test vehicle on the dynamometer and restrain.

8.2.3 Amend subparagraph (d): Practice runs over the prescribed driving schedule may only be performed prior to battery state-of-charge setting, provided the battery state-of-charge was not set prior to securing vehicle to dynamometer and an emission sample is not taken, for the purpose of finding the appropriate throttle action to maintain the proper speed-time relationship, or to permit sampling system adjustment.

8.2.4 Amend subparagraph (f)(2)(i): Immediately after completion of the preconditioning, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period for hybrid electric vehicles that are

charge-sustaining over the USO6, the vehicle shall be momentarily turned off for 5 seconds and turned back on. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on. Hybrid electric vehicles that are charge-depleting over the USO6 and hybrid electric vehicles with auxiliary power units capable of manual activation shall remain turned on during the idle period.

8.2.5 Amend subparagraph (f)(2)(ix): For hybrid electric vehicles that are charge-depleting over the USO6 and hybrid electric vehicles with auxiliary power units capable of manual activation, turn the vehicle off 2 seconds after the end of the last deceleration. For hybrid electric vehicles that are charge-sustaining over the USO6, record the battery state-of-charge and determine if the net energy change of the battery decreased during the USO6 emission test. If the battery experienced a net energy decrease, then repeat dynamometer test run from subparagraph (f)(2)(i). A total of three USO6 emission tests shall be attempted to satisfy the condition requiring that the battery shall not experience a net energy decrease by the end of the emission test. If this condition is not met in three attempts, then retest the hybrid electric vehicle as a charge-depleting over the USO6. Manufacturers may elect to repeat dynamometer test run from subparagraph (f)(2)(i) if battery energy level increased significantly during USO6 emission test.

8.3 SCO3 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 with the following revisions:

8.3.1 Amend subparagraph (o): Air Conditioning Test (SCO3) Preconditioning. (1) If the SCO3 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). Prior to driving SCO3 preconditioning cycle, the battery state-of-charge of the hybrid-electric vehicle shall be set at a level that satisfies one of the following conditions listed in order of hierarchy. Battery state-of-charge setting can be performed before or after securing vehicle to dynamometer. If condition (i) cannot be met, then condition (ii) shall be met. If condition (ii) cannot be met, then condition (iii) shall be met:

(i) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to immediately activate the auxiliary power unit at the beginning of the SCO3 preconditioning cycle.

(ii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to activate the auxiliary power unit within 45 seconds of starting the SCO3 preconditioning cycle.

(iii) Battery state-of-charge shall be set at the level that causes the vehicle's control strategy to operate the auxiliary power unit for the longest amount of cumulative time during the SCO3 preconditioning cycle

If the auxiliary power unit is capable of being manually activated, the battery state-of-charge shall be set to the lowest level allowed by the manufacturer for charge-sustaining hybrid electric vehicles over the SCO3. If the hybrid electric vehicle is charge-depleting over the SCO3, the battery state-of-charge shall be set to the level recommended by the manufacturer for activating the auxiliary power unit when operating under highway driving conditions. Preconditioning consists of a SCO3 test cycle. If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SCO3 preconditioning cycle.

8.3.2 Delete subparagraphs (o)(1)(i) and (o)(1)(ii).

8.4 SCO3 Emission Test

To be conducted pursuant to 40 CFR §86.160-00 with the following revisions:

8.4.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 594 second test on the SCO3 driving schedule, as described in appendix I, paragraph (h), of this part. The hybrid electric vehicle is preconditioned in accordance with §86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (vehicle off) that proceeds directly into the SCO3 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the preconditioning driving, vehicle soak, and SCO3 official test cycle, is either conducted in an environmental test facility or under test conditions that simulates testing in an environmental test cell (see Sec. 86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95°F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m², and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the vehicle 10 minute soak), including the preconditioning. If engine stalling should occur during cycle operation, follow the provisions of §86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO₂, CH₄ and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled

and analyzed continuously according to the provisions of §86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO₂, CH₄ and NO_x.

8.4.2 Amend subparagraph (b)(2): Position (vehicle must be pushed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle can be driven) the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SCO3 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.4 Amend subparagraph (c)(12): For hybrid electric vehicles that are charge-depleting over the SCO3 and hybrid electric vehicles with auxiliary power units capable of manual activation, turn the vehicle off 2 seconds after the end of the last deceleration. For hybrid electric vehicles that are charge-sustaining over the SCO3, record the battery state-of-charge and determine if the net energy change of the battery decreased during the SCO3 emission test. If the battery experienced a net energy decrease, then repeat dynamometer test run from subparagraph (d). A total of three SCO3 emission tests shall be attempted to satisfy the condition requiring that the battery shall not experience a net energy decrease by the end of the emission test. If this condition is not met in three attempts, then retest the hybrid electric vehicle as a charge-depleting over the SCO3. Manufacturers may elect to repeat dynamometer test run from subparagraph (d) if battery energy level increased significantly during SCO3 emission test.

8.4.5 Amend subparagraph (d)(7): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SCO3 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.6 Amend subparagraph (d)(10): For hybrid electric vehicles that are charge-depleting over the SCO3 and hybrid electric vehicles with auxiliary power units capable of manual activation, turn the vehicle off 2 seconds after the end of the last deceleration. For hybrid electric vehicles that are charge-sustaining over the SCO3, record the battery state-of-charge and determine if the net energy change of the battery decreased during the SCO3 emission test. If the battery experienced a net energy decrease, then repeat dynamometer test run from subparagraph (d). A total of three SCO3 emission tests shall be attempted to satisfy the condition requiring that the battery shall not experience a net energy decrease by the end of the emission test. If this condition is not met in three attempts, then retest the hybrid electric vehicle as a charge-depleting over the SCO3.

Manufacturers may elect to repeat dynamometer test run from subparagraph (d) if battery energy level increased significantly during SCO3 emission test.